Epitomes

Important Advances in Clinical Medicine

Emergency Medicine

The Scientific Board of the California Medical Association presents the following inventory of items of progress in emergency medicine. Each item, in the judgment of a panel of knowledgeable physicians, has recently become reasonably firmly established, both as to scientific fact and important clinical significance. The items are presented in simple epitome and an authoritative reference, both to the item itself and to the subject as a whole, is generally given for those who may be unfamiliar with a particular item. The purpose is to assist busy practitioners, students, research workers or scholars to stay abreast of these items of progress in emergency medicine that have recently achieved a substantial degree of authoritative acceptance, whether in their own field of special interest or another.

The items of progress listed below were selected by the Advisory Panel to the Section on Emergency Medicine of the California Medical Association and the summaries were prepared under its direction.

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Autotransfusion

AUTOTRANSFUSION was first used in 1818 by Blundell for postpartum hemorrhage. The Vietnam War showed the need for immediate availability of compatible blood in many cases of major trauma. Cardiopulmonary bypass procedures have provided necessary clinical experience and experimental data. Now cases of civilian trauma are benefiting from the use of autotransfusion.

In an emergency department, autotransfusion offers immediately available blood at room temperature for an exsanguinating patient. Blood supplied by autotransfusion is fresh and compatible. Procoagulation factors VIII and IX, absent in bank blood, are at nearly 100% of normal activity. Platelet levels are low but significantly higher than in bank blood. Hypofibrinogenemia is a consistent finding; however, there is no evidence of coagulopathy until half a patient's blood volume has been retransfused. In transfusions of less than 4,000 ml, the liver can replenish the circulation with fibrinogen. Studies of systemic effects showed no difference in prothrombin, partial prothrombin time, plasma hemoglobin concentration, plasma fibrinogen concentration and fibrinogen-fibrin degradation products in autotransfusion recipients versus recipients of bank blood.

Erythrocyte hemolysis may occur with vacuum collection pressures of greater than 60 mm of mercury. This appears to be well tolerated. No cases of renal failure have been reported.

Sepsis from contaminated blood has been a major concern in autotransfusion. There seems to be minimal risk from isolated hemothorax. Even blood with enteric, biliary or urinary contamination seems to be safe with the administration of broad-spectrum antibiotics. Most authorities consider autotransfusion with contaminated blood advisable only in the most dire circumstances.

Microemboli with pulmonary and renal complications have occurred. This problem is alleviated with micropore filtration. Air embolism has been extremely rare with gravity-assisted reinfusion techniques.

The most common device in emergency departments is the Sorenson autotransfuser. There are many modifications of this basic type of system. It is inexpensive, rapidly assembled and easy to use. Systems incorporating cell washers and pumps are more appropriate in an operating room where a technician is available.

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Ciguatera Toxin Poisoning

CIGUATERA (from *cigua*, the poisonous turban shell snails of the Spanish Antilles) toxin poisoning follows the ingestion of tropical and semitropical benthic marine fish. Most cases involve the barracuda (family Sphyraenidae), red snapper (genus *Lutjanus*), jack (family Carangidae), grouper (family Serranidae) and parrot fish (family Scaridae), which accumulate a series of at least five toxins that originate in the dinoflagellate *Gambierdiscus toxicus*. Larger animals in the food chain assume greater toxicity. The toxin is without taste and is impervious to gastric acid, freezing temperatures and extreme heat.

The toxin, which appears to be composed of lipid-soluble and water-soluble components, possesses cholinomimetic and anticholinesterase activity. Major toxic effects have been linked to sustained depolarization of nerve and muscle membranes, caused by a putative blockade of calcium sites that regulate the passive sodium pores.

Symptoms of ciguatera toxin poisoning are noted from 15 to 30 minutes after ingestion, with rare delay of as long as 24 hours. Gastroenteritis is followed by pruritus, paresthesias,

the pathognomonic reversal of hot and cold sensation, hypersalivation, odontalgia, dysphagia, malaise, myalgias, diffuse or focal weakness, muscle fasciculations, tremor, athetosis, meningismus, ataxia, blurred vision, seizures, bradycardia, hypotension, ascending paralysis, coma and respiratory failure. Fatalities are rare. Vomiting and diarrhea resolve in from 24 to 48 hours; dysesthesias and subtle neurologic abnormalities may persist for as long as two months.

Therapy is supportive. In managing a case of acute ingestion, the use of magnesium-based cathartics should be avoided, as they may augment a calcium channel blockade. Bradyarrhythmias are responsive to administration of atropine sulfate. An intravenous infusion of calcium gluconate for hypotension has been recommended, but this treatment is as yet empirical.

The lipid-soluble component can be extracted from fish flesh with serial solvent elutions. A radioimmunoassay can detect ciguatera toxin in fish flesh, but does not identify a human syndrome. Although counterimmunoelectrophoresis of toxic (human reaction or in vivo mouse bioassay) fish extracts and human serum confirms toxic fish specimens, specimens of both immune and nonimmune human serum show precipitin reactions with toxic extracts. Therefore, it is not yet possible to conclude that affected persons have ciguatera toxin-specific antibody. Until further tests are available, the diagnosis of ciguatera toxin poisoning must be made clinically.

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The Use of Hemoperfusion to Treat Poisoning and Drug Overdose

THE GOAL in treating a case of poisoning is to limit the effects of the poison and thus prevent death or serious complications. The simplest way to prevent toxic effects is to interrupt absorption from the gastrointestinal tract with gastric-emptying procedures and adsorption with activated charcoal. Once the toxin has been absorbed into the body, its toxicity may be countered by intensive supportive care including airway protection, assisted ventilation and fluid management. These widely used treatments have reduced the mortality of poisoned patients requiring hospital care to less than 1%. More invasive and complex methods such as hemoperfusion, which increases the elimination of poisons from the system after absorption, have been widely used but poorly studied.

Hemoperfusion is done by passing a victim's blood directly over an adsorbent material (charcoal or resin) and returning the filtered blood to the patient. Standard hemodialysis roller pumps and vascular catheters are used, and the patient must be receiving heparin. Flow rates of as high as 300 ml per minute can be achieved, and when there is good extraction by the adsorbent column, significant removal is possible for some toxins. However, for a drug or poison to be effectively eliminated from the body, it must be readily accessible for such blood "cleansing"—that is, it should not be highly tissue bound or otherwise sequestered outside of the bloodstream. Thus, drugs with very large volumes of distribution, such as digoxin, tricyclic antidepressants, phenothiazines and narcotics, are unlikely to be significantly removed, whereas those with small volumes of distribution, such as theophylline, phenobarbital, salicylate and acetaminophen, are readily available for elimination.

Before undertaking hemoperfusion, one must decide whether the benefits of accelerated toxin removal outweigh the risks of vascular access and anticoagulation. For most cases of intoxication, simple supportive measures are satisfactory. Situations that might prompt the use of hemoperfusion include clinical deterioration despite maximal supportive measures; the presence of a known lethal dose or blood concentration, or the loss of normal excretory mechanisms, such as with renal or hepatic failure.

Hemoperfusion may be undertaken for phenobarbital overdose when hypotension and metabolic acidosis persist despite warming, fluids and pressors. It is indicated for theophylline intoxication when there are intractable seizures or when blood concentrations are very high (above 100 mg per liter, or 60 mg per liter in patients with chronic, accidental overmedication). It is currently recommended for cases of paraquat poisoning—even though the elimination rate is low—because of the lethality of untreated intoxication. Although hemoperfusion has been used for cases of tricyclic-antidepressant overdose, it has not been shown to remove significant amounts of the drug or its metabolites.

Although hemoperfusion is a useful method of removing some toxins, it has limited indications. Complications include vascular trauma from catheter placement, local hematomas, air embolism, intracranial bleeding and thrombocytopenia. Repeated-dose oral activated charcoal may eventually prove to be a preferable method of accelerated elimination in some patients, especially those with less severe poisoning or with contraindications to heparinization.

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The Computer as Physician? Automatic External Defibrillation

RECENT EVIDENCE has suggested rather convincingly that early external defibrillation is the single most important factor in successfully reversing out-of-hospital cardiac arrest. However, many communities have neither the patient volume nor the financial resources to initiate and maintain full advanced life-support skills in their emergency medical services personnel. Basic emergency medical technicians can be trained to recognize and treat cases of ventricular fibrillation, and clinical studies have shown improvement in hospital discharge rates of around 15% for cardiac arrest victims so treated. Unfortunately, such training is not inexpensive and requires frequent refresher courses. A computerized,